

## BIOGRAPHICAL INFORMATION

Max R. Zelle

BORN: Polk County, Iowa, October 11, 1915

EDUCATION: Diploma, Alleman High School, Alleman, Iowa 1932, Valedictorian.  
B.S. degree in Animal Husbandry, Iowa State College, March, 1937.  
Ph.D. degree in Genetics, Iowa State College, December, 1940.

### POSITIONS AND EXPERIENCE:

1935-36 Asst. County Agricultural Agent, Iowa State Extension Service,  
Audubon, Iowa

1937-38 Fellowship in Genetics, Iowa State College

1938-40 Graduate Assistant In Genetics, Iowa State College

1940-44 Assistant Professor of Animal Husbandry (Genetics), Purdue University

1944-46 Ensign and Lt. (j.g.) USNR, Classified Research on Biological Warfare,  
Camp Detrick, Frederick, Maryland

1946-48 Biologist, Laboratory of Physical Biology, National Institutes of  
Health, Bethesda, Maryland

1948-58 Professor of Bacteriology, Cornell University, Ithaca, New York

1950-51 Geneticist, Biology Branch, Division of Biology and Medicine, Atomic  
Energy Commission, Washington, D. C. (On leave from Cornell Univ.)

1951-54 Consultant, Division of Biology and Medicine, Atomic Energy Commission

1947-49 & 1952-57 Consultant, Biology Division, Oak Ridge National Laboratory, Oak Ridge,  
Tennessee

1952, '54 and '56 Summer Guest Investigator, Biology Division, Oak Ridge National  
Laboratory, Oak Ridge, Tennessee

1957-58 Geneticist, Biology Branch, Division of Biology and Medicine, Atomic  
Energy Commission, Washington, D. C. (On leave from Cornell Univ.)

1958-60 Chief, Biology Branch, Division of Biology and Medicine, Atomic  
Energy Commission, Washington, D. C.

1960-61 Assistant Director for Biological Sciences, Division of Biology and  
Medicine, Atomic Energy Commission, Washington, D. C.

1961-62 Professor of Genetics and Director, Center for Radiological Sciences,  
University of Washington, Seattle, Washington

1962-69 Director, Division of Biological and Medical Research, Argonne National  
Laboratory, Argonne, Illinois

POSITIONS AND EXPERIENCE: (Con't)

- 1958-65 Advisor to United States delegation to the United Nations Scientific Committee on the Effects on Atomic Radiation
- 1963-69 Lecturer in Zoology, University of Chicago, Chicago, Illinois
- 1963-72 Member of Editorial Board, Mutation Research
- 1965-74 Co-editor, Advances in Radiation Biology series: Academic Press
- 1969-73 Member, Radiological Health Study Section, Bureau of Radiological Health, Food and Drug Administration, Department of Health, Education and Welfare
- 1969 + Chairman, Department of Radiology and Radiation Biology, Colorado State University, Fort Collins, Colorado
- 1970 Member, Search Committee for Dean of College of Veterinary Medicine and Biomedical Sciences
- 1970-73 Member, Editorial Board, Applied Microbiology
- 1970-73 Member, Steering Committee, Western Interstate Nuclear Board, Denver, Colorado
- 1971-74 Faculty Council, CSU, Representative at large
- 1971-75 Member, Cultural Programs Advisory Committee, CSU
- 1971-73 Member of Steering Committee, Faculty Council, CSU
- 1972 + Radiation Control Officer and Member, Radiation Safety Committee, CSU
- 1972 Consultant, U. S. Atomic Energy Commission, Plowshare Programs Office
- 1974 Chairman, Search Committee for Associate Professor of Radiology
- 1975 + Member, Intersociety Liason Committee, Health Physics Society
- 1974-76 Member, Faculty Benefits Committee, CSU
- 1976-77 Chairman, Faculty Benefits Committee, CSU
- 1976-77 Chairman, Search Committee for Associate Professor of Radiological Physics
- 1977 Chairman, Search Committee for Director of Collaborative Radiological Health Laboratory
- 1977 Chairman, Search Committee for Head of Microbiology
- 1978 Chairman, Search Committee for Associate Dean, College of Veterinary Medicine and Biomedical Sciences
- 1978 Consultant, University of Tennessee Institute of Radiation Biology
- 1979 Consultant, American Pharmaceutical Association
- 1979+ Member, CSU Committee on Responsibilities and Standing of the Academic Faculty
- 1980+ Member, CSU Advisory Committee for Adult Students

HONORS AND PROFESSIONAL SOCIETIES:

Honor Student, College of Agriculture, Iowa State University  
Scabbard and Blade, Military Honorary  
Alpha Zeta, Agricultural Honorary  
Sigma Xi  
Phi Kappa Phi  
Who's Who in the World (4th Edition, 1978)  
Who's Who in America  
Who's Who in the West  
Who's Who in Atoms  
Listed in the Blue Book; Leaders of the English Speaking World  
Dictionary of International Biography  
Honorary Editorial Board, Photochemistry and Photobiology 1962-1970  
Cosmos Club, Washington, D. C.  
American Association for Advancement of Science, Fellow 1955  
American Institute of Biological Sciences  
American Society for Microbiology  
American Society of Naturalists  
American Society for Photobiology  
Genetics Society of America  
Radiation Research Society: Councilor in Biology, 1960-63; Secretary-Treasurer  
Elect 1971; Secretary-Treasurer 1972-75; Member, Committee for Advancement  
of Radiation Research, 1974-76; Chairman, Education Committee 1974-77  
Health Physics Society: President, Central Rocky Mountain Chapter 1976-1977

RESEARCH INTERESTS: Radiation Biology, Genetics, Microbiology

## BIBLIOGRAPHY

Open Literature Publications:

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- Shrewsbury, C. L., C. Harper, F. N. Andrews, and M. R. Zelle. 1942. The limitations of oat straw as a roughage for maintenance, lactation and growth in sheep. *J. Animal Sci.* 1: 126-130.
- Shrewsbury, C. L., F. N. Andrews, C. Harper, and M. R. Zelle. 1943. The value of alfalfa and certain of its fractions in the nutrition of breeding ewes. *J. Animal Sci.* 2: 209-220.
- Gowen, J. W., and M. R. Zelle. 1945. Irradiation effects on genetic resistance of mice to mouse typhoid. *J. Infectious Diseases* 77: 85-91.
- Young, G. A., Jr., M. R. Zelle, and R. E. Lincoln. 1946. Respiratory pathogenicity of Bacillus anthracis spores. I. Methods of study and observations on pathogenesis. *J. Infectious Diseases* 79: 233-246.
- Zelle, M. R., R. E. Lincoln, and G. A. Young, Jr. 1946. Respiratory pathogenicity of Bacillus anthracis spores. II. Genetic variation in respiratory pathogenicity and invasiveness of colonial variants of B. anthracis. *J. Infectious Diseases* 79: 247-253.
- Lincoln, R. E., M. R. Zelle, C. I. Randles, J. L. Roberts, and G. A. Young, Jr. 1946. Respiratory pathogenicity of Bacillus anthracis spores. III. Changes in pathogenicity due to nutritional modifications. *J. Infectious Diseases* 79: 254-265.
- Young, G. A., Jr., and M. R. Zelle. 1946. Respiratory pathogenicity of Bacillus anthracis spores. IV. Chemical-biological synergisms. *J. Infectious Diseases* 79: 266-271.
- Jarrett, E. T., Lt. (HC) USN, M. R. Zelle, and A. Hollaender. 1948. Studies of the control of acute respiratory disease among naval recruits. II. Limitations of ultraviolet irradiation in reducing air-borne bacteria in barracks with low ceilings. *Am. J. Hyg.* 48: 233-239.
- Buck, J. B., M. L. Keister, and M. R. Zelle. 1950. An areal method for calibrating microburettes. *Anal. Chim. Acta* 4: 130-134.
- Zelle, M. R. 1951. A simple single-cell technique for genetic studies of bacteria. *J. Bacteriol.* 61: 345-349.

Open Literature Publications, con't:

- Zelle, M. R., and J. Lederberg. 1951. Single-cell isolations of diploid heterozygous Escherichia coli. J. Bacteriol. 61: 351-355.
- Dondero, N. C., and M. R. Zelle. 1953. Observations on the formation and behavior of "conjugation" cells and large bodies in Azotobacter agile. Science 118: 34-36.
- Dondero, N. C., and M. R. Zelle. 1953. A method for retaining bacterial cells in place for staining and cytochemical tests for light or electron microscopy. J. Histochem. Cytochem. 1: 415-419.
- Zelle, M. R., and A. Hollaender. 1954. Monochromatic ultraviolet action spectra and quantum yields for inactivation of T1 and T2 Escherichia coli bacteriophages. J. Bacteriol. 68: 210-215.
- Dondero, N. C., H. I. Adler, and M. R. Zelle. 1954. Quantification of the Feulgen reaction in bacteria. J. Bacteriol. 68: 483-492.
- Zelle, M. R., and A. Hollaender. 1955. Effects of radiation on bacteria. In: Radiation Biology, Vol. II: Ultraviolet and Related Radiations. Ed.: A. Hollaender. New York: McGraw-Hill Book Co., Inc., pp: 365-430.
- Zelle, M. R. 1955. Symposium on radiation effects on cells and bacteria. Part 3. Radiation induced mutations and their implications on the mechanisms of radiation effects on bacteria. Bacteriol. Rev. 19: 32-44.
- Hollaender, A., and M. R. Zelle. 1954. The use of action spectra for the evaluation of some basic biological problems. In: Proceedings of the First International Photobiology Congress (Amsterdam, Aug. 23-28, 1954). The Netherlands: H. Veenman and Zonen - Washington, pp. 128-134.
- Zelle, M. R. 1955. Genetics of microorganisms. In: Annual Review of Microbiology, Vol. 9. Ed.: C. E. Clifton. Stanford, Calif.: Annual Reviews, Inc., pp. 45-96.
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- Adler, H. I., and M. R. Zelle. 1957. Quantitative evaluation of the effects of various methods of fixation on the appearance of stained structures in the bacterial cell. J. Bacteriol. 73: 526-529.
- Ogg, J. E., and M. R. Zelle. 1957. Isolation and characterization of a large cell possibly polyploid strain of Escherichia coli. J. Bacteriol. 74: 477-484.

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- Zelle, M. R., and J. E. Ogg. 1957. Radiation resistance and genetic segregation in a large cell possibly polyploid strain of Escherichia coli. J. Bacteriol. 74: 484-493.
- Zelle, M. R., J. E. Ogg, and A. Hollaender. 1957. Differential photo-reactivation of Escherichia coli after exposure to 2650 and 2250A ultraviolet. Poc. Soc. Exptl. Biol. Med. 96: 285-287.
- Zelle, M. R. 1957. Some observations bearing on the nature of lethal radiation damage in Escherichia coli. In: Proceedings of the Second International Photobiology Congress (Turin, Italy, June 2-8, 1957). Edizioni Minerva Medica, Turin, Italy, pp. 155-166.
- Zelle, M. R., J. E. Ogg, and A. Hollaender. 1958. Photoreactivation of induced mutation and inactivation of Escherichia coli exposed to various wave lengths of monochromatic ultraviolet radiation. J. Bacteriol. 75: 190-198.
- Zelle, M. R. 1958. Diagnostic X-rays from the viewpoint of a geneticist. Med. Ann. of the District of Columbia, 27: 455-459.
- Totter, J. R., M. R. Zelle, and H. Hollister. 1958. The biological hazard to man of carbon-14 from nuclear weapons. 19 pp. Washington Technical Report, WASH-1008. Atomic Energy Commission. Technical Information Service Extension, Oak Ridge, Tennessee. Also published in Science 124: 1490-1495 (1958).
- Zelle, M. R. 1960. Radioisotopes and the genetic mechanism: Mutagenic aspects. In: Radioisotopes in the Biosphere. Ed.: R. S. Caldecott and L. A. Snyder. Minneapolis, Minn.: Center for Continuation Study of the General Extension Division, University of Minnesota, pp. 160-180.
- Zelle, M. R. 1960. Modification of radiation effects in bacteria. In: Developments in Industrial Microbiology. New York: Plenum Press, Vol. 1, pp. 222-230.
- Zelle, M. R. 1960. Biological effects of ultraviolet radiation. IRE Transactions on Medical Electronics, Vol. ME-7, No. 3, pp. 130-135.
- Zelle, M. R. 1961. Reports on biological effects of radiation--Somatic and genetic studies: Large-scale programmes. Can. J. Genet. Cytol. 3: 80-81.
- Zelle, M. R. 1962. Biological and agricultural uses of radioisotopes and radiation. Intern. J. Applied Radiation and Isotopes 13: 319-323. Pergamon Press Ltd.

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- Zelle, M. R. 1967. Radiation in relation to basic biology. Proceedings of the Conference on Radiation Biology, Oak Ridge, Tenn., Aug. 2-5, 1965, pp. 1-8. U. S. Atomic Energy Commission Division of Technical Information Conf-650747, Sept., 1967.
- Krisch, R. E., and M. R. Zelle. 1969. Biological effects of radioactive decay: The role of the transmutation effect. In: Advances in Radiation Biology. New York: Academic Press Inc., Vol. III, pp. 177-213.
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- Zelle, M. R. 1970. Dr. John W. Gowen, Obituary. Rad. Res. 42: 425-427.
- Kvetkas, Marilyn J., R. E. Krisch, and M. R. Zelle. 1970. Genetic and physiological studies of a large-cell, radiation-resistant strain of Escherichia coli. I. Genetic analysis of Escherichia coli P6. J. Bacteriol. 103:393-399.
- Zelle, M. R. 1971. Dr. Douglas E. Smith - Physiologist and Photobiologist. In: NATO International Advanced Study Institute on Biological Effects of Visible Light. Photochemistry and Photobiology of Photodynamic Action. Research Progress in Organic, Biological and Medicinal Chemistry. North Holland Publishing Co. Vol. 3, Part 1: 270-273.
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Zelle, M. R. 1974. Human Genetic Concerns. In: Environment and Colorado - A Handbook. Phillip O. Foss Editor. Published by the Environmental Resources Center, Colorado State University, Fort Collins, Colo. pp. 65-69.

Abstracts:

- Zelle, M. R., and J. W. Gowen. 1940. On the origin of epidemic virulence. Genetics 25: 140-141.
- Zelle, M. R. 1941. On the mechanism of variegation in bacterial colonies. Genetics 26: 174.
- Zelle, M. R., and J. W. Gowen. 1941. Interaction of the genetic constitutions of host and pathogen in mouse typhoid. Genetics 26: 174-175.
- Zelle, M. R., and J. E. Ogg. 1954. Attempts to produce polyploidy in Escherichia coli by camphor vapors. Bacteriol. Proc. 54: 39-40.
- Ogg, J. E., and M. R. Zelle. 1955. Radiation inactivation kinetics of a presumed polyploid strain of Escherichia coli. Bacteriol. Proc. 55: 58.
- Zelle, M. R., and R. R. Alexander. 1957. Ultraviolet absorption coefficients and total cell counts of Escherichia coli strains. Bacteriol. Proc. 57: 48.
- Zelle, M. R. 1958. Studies of a large cell, radiation resistant, possibly polyploid strain derived from Escherichia coli B/r. In: Proceedings of the Tenth International Congress of Genetics (Montreal, Canada, Aug. 20-27). Toronto, Ontario, Canada: Univ. of Toronto Press, pp. 331-332.
- Zelle, M. R. 1959. Biological effects of ultraviolet radiation. In: Digest of Technical Papers, 12th Annual Conference on Electrical Techniques in Medicine and Biology (Philadelphia, Pa., Nov. 10-12) New York: Lewis Winner, p. 18.
- Kvetkas, Marilyn J., and M. R. Zelle. 1967. Genetic analysis of a large-cell, radiation-resistant strain of Escherichia coli. Microbial Genetics Bulletin, Oak Ridge National Laboratory 27: 7-8.
- Kvetkas, Marilyn J., and Max R. Zelle. 1968. Genetic analysis of a large-cell, radiation-resistant strain of Escherichia coli. Bacteriol. Proc. 68: 62.
- Kvetkas, Marilyn J., Robert E. Krisch, and Max R. Zelle. 1970. Physiological studies of a large-cell, radiation-resistant, mutant strain of Escherichia coli. Bacteriol. Proc. 70: 38.
- Zelle, M. R. 1969. Dr. Douglas E. Smith - Physiologist and photobiologist. In: NATO International Advanced Study Institute on Biological Effects of Visible Light. Photochemistry and Photobiology of "Photodynamic Action." Univ. of Sassari, Sardinia, Italy, Sept. 3-17, 1969, pp. 106-107.

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Abstracts, con't:

Zelle, M. R. 1969. Genetic effects in microorganisms. In: NATO International Advanced Study Institute on Biological Effects of Visible Light. Photochemistry and Photobiology of "Photodynamic Action." Univ. of Sassari, Sardinia, Italy, Sept. 3-17, 1969, pp. 108-109.

Zelle, M. R. 1971. Genetic implications of ionizing radiation exposure. Abstract of invited talk in Plenary Session of 16th Annual Meeting of the Health Physics Society. Health Physics, 21: Supplement (abstracts) page 7.

Argonne National Laboratory Annual Reports:

Kvetkas, M., and M. R. Zelle. 1966. Genetic analysis of a large cell strain of Escherichia coli. ANL-7278, pp. 162-164.

Rehfeld, C. E., M. R. Zelle, D. E. Doyle, J. A. Pagels, and M. H. Dipert. 1967. Analysis of familial influence on mean erythrocyte volume. ANL-7409, pp. 117-119.

Kvetkas, M. J., and M. R. Zelle. 1967. Genetic analysis of a large cell strain of Escherichia coli. ANL-7409, pp. 142-143.

Kvetkas, M. J., R. E. Krisch, and M. R. Zelle. 1968. Genetical and physiological studies of a large-cell, radiation-resistant strain of Escherichia coli. Part I. Genetic analysis. ANL-7535, pp.1-3.

Kvetkas, M. J., R. E. Krisch, and M. R. Zelle. 1968. Genetical and physiological studies of a large-cell, radiation-resistant strain of Escherichia coli. Part II. Physiological studies. ANL-7535, pp. 3-5.

Fritz, T. E., R. C. Zeman, and M. R. Zelle. 1969. Studies of the physiology of the Beagle thyroid gland. II. Pathology and familial incidence of thyroiditis in a closed Beagle colony. ANL-7635, pp. 107-108.

ABSTRACTS OF PAPERS PRESENTED AT THE 1939 MEETINGS  
OF THE GENETICS SOCIETY OF AMERICA

COLUMBUS, OHIO, DECEMBER 28-30, 1939

E. W. LINDSTROM, *Secretary*  
*Department of Genetics*  
*Iowa State College, Ames, Iowa*

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ZELLE, M. R., and GOWEN, JOHN W., Iowa State College, Ames, Iowa: *On the origin of epidemic virulence.*—When an epidemic starts, a concatenation of events occurs which enables a particular pathogen to sweep through a species. To particularize these events constitutes a most significant problem of disease resistance. If host and pathogen are closely integrated, one must change in susceptibility or the other in invasive power if epidemic disease proportions are reached. Following SCIOTT'S experiments, our own have shown that susceptibility or resistance in different host populations may be markedly increased by 25 generations of controlled breeding. But these changes are too slow to explain the shift from a stable population to the unbalance of epidemics. The immediate origin seems rather in mutation of the pathogen's virulence. The selective force isolating and purifying the population to the invasive type would lie in the hosts.—Four experiments with mouse typhoid, *S. actrycke*, support this analytical view. In experiments 1, 2 and 4 the host type did not materially influence virulence. The third experiment was markedly different. Bacteria, passed through resistant mice, suddenly became the most virulent experienced; those through the susceptible mice showed no such change. Reversal of hosts caused the very slightly virulent strain, previously inhabiting the susceptible mice, to gain virulence explosively in the third passage through resistant mice. The virulent strain from resistant mice, passed through the susceptibles, remained stable. The results thus far indicate infrequent pathogenic mutation with host selection as a cause of epidemic virulence, agreeing with work of WELLHAUSEN (1937) and LINCOLN (1939) on the corn bacterial wilt relationship.

ABSTRACTS OF PAPERS PRESENTED AT THE 1940 MEETINGS  
OF THE GENETICS SOCIETY OF AMERICA

PHILADELPHIA, PA., DECEMBER 30—JAN. 1, 1941

E. W. LINDSTROM, *Secretary*  
*Department of Genetics*  
*Iowa State College, Ames, Iowa*

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ZELLE, MAX R., and GOWEN, JOHN W., Iowa State College, Ames, Iowa:  
*Interaction of the genetic constitutions of host and pathogen in mouse typhoid.*—  
Among the factors responsible for the inception of epidemic disease, the sudden appearance of a highly virulent pathogen in a susceptible community is of first importance. The findings of these investigations indicate that high virulence results from the rare occurrence of a more pathogenic mutant within the bacterial population. Selection of the virulent form in the host results in the virulent form replacing the avirulent. The environments within genetically resistant and susceptible mice are equally favorable to the virulent bacteria. Four experiments, in each of which the same initial culture of *Salmonella typhimurium* was passed through both resistant and susceptible mice, uphold this viewpoint. In the first two experiments the original culture was a mixture of bacterial types differing in virulence. Increases in virulence occurred in both resistant and susceptible mice. The initial culture for the third experiment was a single cell culture of low virulence and slightly rough colony type. Ten passages through susceptible hosts resulted in no change in virulence. After one passage through resistant mice, virulence changed suddenly to significantly higher virulence. Examination of the resulting bacterial population showed it of predominately smoother colony type than its parent. Particular strains of virulent and avirulent bacteria may be classified by their phenotypic appearance. The differential replacement of the avirulent by the virulent bacteria has been checked by introducing known mixtures of the two types into susceptible and resistant hosts.

ABSTRACTS OF PAPERS PRESENTED AT THE 1940 MEETINGS  
OF THE GENETICS SOCIETY OF AMERICA

PHILADELPHIA, PA., DECEMBER 30—JAN. 1, 1941

E. W. LINDSTROM, *Secretary*  
*Department of Genetics*  
*Iowa State College, Ames, Iowa*

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ZELLE, MAX R., Iowa State College, Ames, Iowa: *On the mechanism of variegation in bacterial colonies.*—An unstable smooth colony culture of *Salmonella typhimurium* exhibiting a high mutation rate to a stable rough type has been studied by a technique designed to demonstrate that, at least in this instance, the S→R transformation is a discontinuous change. The parent strain is a single-celled, smooth organism whose progeny are invariably mixtures of smooth and rough types. Rough colonies from this mixture give only rough. Employing a modified micromanipulator technique, single cells from a smooth colony are seeded upon a thin film of agar mounted on a cover slip in a moist chamber. After division the two daughter cells are separated by a microneedle and their location marked. Upon further division the separation is repeated until ultimately the cells are allowed to develop microcolonies which are transferred to broth, incubated, and plated. If the original single cell was smooth, the ultimate single cell progeny cultures derived from it exhibit both colony types. If the ultimate single cell progeny isolated is a rough mutation then only rough colonies develop. Two mutations have occurred in 302 single-cell isolations of this type giving a mutation rate of 0.0066 per cell generation. In one of these isolates its sib-cell was inviable; in the other its sib-cell was smooth. Considering only the manner in which the changes occur, the simplest hypothesis is that the bacteria are haploid with a high mutation rate for the particular locus. However, the significantly higher frequency of inviable cells among the smooth bacteria indicate a more complex mechanism.